

# An Introduction To Electrospinning And Nanofibers

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Electrospinning Seeram Ramakrishna Joachim H. Wendorff Xungai Wang Seema Agarwal Ashok Vaseashta Mehdi Afshari Sajjad Haider A. K. Haghi Maria Mathew Zhenyu Li Santosh Kumar Tiwari A. K. Haghi Arkadii Arinstein Yanbo Liu Bin Ding Rajkishore Nayak Praveen K.M. Nesrin Horzum Sajjad Haider  
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the research and development of nanofibers has gained much prominence in recent years due to the heightened awareness of its potential applications in the medical engineering and defense fields among the most successful methods for producing nanofibers is the electrospinning process in this timely book the areas of electrospinning and nanofibers are covered for the first time in a single volume

the book can be broadly divided into two parts the first comprises descriptions of the electrospinning process and modeling to obtain nanofibers while the second describes the characteristics and applications of nanofibers the material is aimed at both newcomers and experienced researchers in the area

electrospinning is from the academic as well as technical perspective presently the most versatile technique for the preparation of continuous nanofibers obtained from numerous materials including polymers metals and ceramics shapes and properties of fibers can be tailored according to the demand of numerous applications including filtration membranes textiles catalysis reinforcement or biomedical applications this book summarizes the state of the art in electrospinning with detailed coverage of the various techniques material systems and their resulting fiber structures and properties theoretical aspects and applications throughout the book the current status of knowledge is introduced with a critical view on accomplishments and novel perspectives an experimental section gives hands on guidance to beginners and experts alike

the book covers the basic electrospinning theory electrospinning technologies that have potential for large scale production of nanofibers and the functional applications of electrospun nanofibers in different fields an important needleless electrospinning technique using a rotary fiber generator such as ball cylinder disc and wire coil and the effects of the fiber generator its shape and dimension as well as operating parameters on electrospinning performance fiber morphology and productivity are described a method to calculate the electric field and analyze electric field profiles in an electrospinning zone is provided the influence of the fiber collector on fiber quality is also discussed

focuses on basic aspects of nanomicrofibers made by electrospinning with details on spinning recipes characterization techniques and chemistry of the polymers in use the basic understanding provided in the book is useful for producing 1d and 3d fibrous structures with specific properties for applications e.g. textiles membranes reinforcements catalysis filters or biomedical uses students and practitioners will find great value in the step by step instructions how to manufacture nanofibers electrospinning equipment history of electrospinning and nanofibers characterization fundamentals of electrospun fibers ready made recipes for spinning solutions conditions for the productions of highly diverse fiber morphologies and arrangements chemistry of fiber forming materials

this book presents the development of electrospun materials fundamental principles of electrospinning process controlling parameters

electrospinning strategies and electrospun nanofibrous structures with specific properties for applications in tissue engineering and regenerative medicine textile water treatment sensor and energy fields this book can broadly be divided into three parts the first comprises basic principles of electrospinning process general requirements of electrospun materials and advancement in electrospinning technology the second part describes the applications of electrospun materials in different fields and future prospects while the third part describes applications that can be used in advanced manufacturing based on conjoining electrospinning and 3d printing electrospinning is the most successful process for producing functional nanofibers and nanofibrous membranes with superior chemical and physical properties the unique properties of electrospun materials including high surface to volume ratio flexibility high mechanical strength high porosity and adjustable nanofiber and pore size distribution make them potential candidates in a wide range of applications in biomedical and engineering areas electrospinning is becoming more efficient and more specialized in order to produce particular fiber types with tunable diameter and morphology tunable characteristics having specific patterns and 3d structures with a strong focus on fundamental materials science and engineering this book provides systematic and comprehensive coverage of the recent developments and novel perspectives of electrospun materials this comprehensive book includes chapters that discuss the latest and emerging applications of nanofiber technology in various fields specifically in areas such as wearable textile biomedical applications energy generation and storage water treatment and environmental remediation and sensors such as biomarkers in healthcare and biomedical engineering despite all these advancements there are still challenges to be addressed and overcome for nanofiber technology to move towards maturation

electrospun nanofibers covers advances in the electrospinning process including characterization testing and modeling of electrospun nanofibers and electrospinning for particular fiber types and applications electrospun nanofibers offers systematic and comprehensive coverage for academic researchers industry professionals and postgraduate students working in the field of fiber science electrospinning is the most commercially successful process for the production of nanofibers and rising demand is driving research and development in this field rapid progress is being made both in terms of the electrospinning process and in the production of nanofibers with superior chemical and physical properties electrospinning is becoming more efficient and more specialized in order to produce particular fiber types such as bicomponent and composite fibers patterned and 3d nanofibers carbon nanofibers and nanotubes and nanofibers derived from chitosan provides systematic and comprehensive coverage of the manufacture properties and applications of nanofibers covers recent developments in nanofibers materials including electrospinning of bicomponent chitosan carbon and conductive fibers brings together expertise from academia and industry to provide comprehensive up to date information on nanofiber research and development

offers systematic and comprehensive coverage for academic researchers industry professionals and postgraduate students working in the field of fiber science

this book focuses on the recent advancements in the process parameters research and applications of electrospinning and electrospinning the first chapter introduces the techniques and the effect of the parameters on the morphology of the nanofiber and nanoparticles and then the subsequent chapters focus on the applications of these techniques in different areas this book will attract a broad audience including postgraduate students and industrial and academic investigators in sciences and engineering who wish to enhance their understanding of the emerging technologies and use this book as reference

electrospinning of nanofibers has emerged as a specialized processing technique for the formation of sub micron fibers with high specific surface areas electrospinning of nanofibers in textiles presents important new research in the dynamic and emerging field of electrospinning and covers all aspects of the technology as used to produce nanofibers

this book introduces readers to electrospinning a nanofabrication technique used to produce nanofibers and discusses the properties and applications of these nanofibers the book begins with an overview of the electrospinning process and strategies for producing nanofibers with different morphologies the advantages and limitations of the nanofiber technology and future outlook are addressed next then recent and novel applications of electrospun nanofibers in different areas including biomedical environmental textile and energy are discussed followed by a more detailed review of the fabrication and properties of electrospun nanofiber membranes and composites

one dimensional nanostructures electrospinning technique and unique nanofibers is a comprehensive book depicting the electrospinning technique and related 1d unique electrospun nanofibers the first part of the book focuses on electrospinning technique with chapters describing electrospinning setup electrospinning theories and related working parameter the second part of the book describes in detail specific topics on how to control the electrospun fiber properties such as how to control the fiber direction how to control the fiber surface morphology how to control the fiber structure and how to construct 3d structures by electrospun fibers the final part of the book depicts the applications of the electrospun nanofibers with sections describing in detail specific fields such as electrospun nanofiber reinforcement filtration electronic devices lithium ion batteries fuel cells biomedical field and so on one dimensional nanostructures electrospinning technique and unique nanofibers is designed to bring state of the art on electrospinning together into a single book and

will be valuable resource for scientists in the electrospinning field and other scientists involved in biomedical field mechanical field materials and energy field dr zhenyu li is an associate professor at the dept of chemistry jilin university changchun p r china currently he also holds the position in australian future fibres research innovation centre institute for frontier materials deakin university geelong victoria australia dr ce wang is a professor at the dept of chemistry jilin university changchun p r china

the book provides an up to date account of the various techniques of fabrication functionalization of electrospun nanofibers as well as recent advancements an overview of the advanced applications of such techniques in different areas is also presented both experimental and theoretical approaches related to electrospun nanofibers are covered along with a discussion on the inherent properties of electrospun nanofibers therefore this book provides a unique resource not only to established researchers but also newcomers starting out in this field

this new book presents some fascinating phenomena associated with the remarkable features of nanofibers in electrospinning processes and new progress in applications of electrospun nanofibers this book offers an overview of structureproperty relationships synthesis and purification and potential applications of electrospun nanofibers the collection of topics in this book reflects the diversity of recent advances in electrospun nanofibers with a broad perspective

discussing the electrospinning process the book covers in great depth the current research interest in nanoscience and nanotechnology especially electrospinning of polymer nanofibers the main distinction of the proposed book from others devoted to the electrospinning process is in the consideration of the problem in question from the physical point of view focusing on physical aspects the book contains physical basics regarding the unique features of electrospun polymer nanofibers and the electrospinning resulting in fabrication of these nanofibers

this book comprehensively addresses advanced nanofiber manufacturing based on electrospinning technology the principles relationships between process parameters and structure morphology and performance of electrospun nanofibers and nanomaterials and the methods for enhanced field intensity and uniform distribution are discussed the electric field intensity and distribution during electrospinning is also analyzed based on finite element analysis on both the needle and the needleless electrospinning furthermore the modification techniques for improved nanomaterials strength are covered aiming to provide effective avenues towards the manufacture

of stronger nanofiber or nanomaterial products

this book offers a comprehensive review of the latest advances in developing functional electrospun nanofibers for energy and environmental applications which include fuel cells lithium ion batteries solar cells supercapacitors energy storage materials sensors filtration materials protective clothing catalysis structurally colored fibers oil spill cleanup self cleaning materials adsorbents and electromagnetic shielding this book is aimed at both newcomers and experienced researchers in the field of nanomaterials especially those who are interested in addressing energy related and environmental problems with the help of electrospun nanofibers bin ding phd and jianyong yu phd are both professors at the college of materials science and engineering donghua university china

this book provides a comparison between melt electrospinning and meltblowing as techniques for the production of polypropylene nanofibers the author compares the morphological structural chemical and mechanical characteristics of the different produced fibers moreover the degree of thermal degradation of the different fibers is also analyzed the book is useful to chemists and material scientists working on the synthesis of nanofibers by melt processes showing the limitations of each technique for nanofiber fabrication

nanofibers are possible solutions for a wide spectrum of research and commercial applications and utilizing inexpensive bio renewable and agro waste materials to produce nanofibers can lower manufacturing cost via electrospinning this book explains synthesis of green biodegradable and environmentally friendly nanofibers from bioresources their mechanical and morphological characteristics along with their applications across varied areas it gives an elaborate idea on conductive polymers for tissue engineering application as well features provides insight about electrospun nanofibers from green biodegradable and environmentally friendly bio resources reviews surface characterization of electrospun fibers covers diversified applications such as cancer treatment covid 19 solutions food packaging applications textile materials and flexible electronic devices describes the combined use of 3d printing and electrospinning for tissue engineering scaffolds includes melt electrospinning technique and its advantages over solution electrospinning this book aims at researchers and graduate students in material science and engineering environmental engineering chemical engineering electrical engineering mechanical engineering and biomedical engineering

the last two decades have seen electrospinning of nanofibers performed mainly from solutions of toxic organic solvents the increase in demand for scaling up electrospinning in recent years therefore requires an environmentally friendly process free of organic solvents this

book addresses techniques for clean and safe electrospinning in the fabrication of green nanofibers and their potential applications

this is a timely an informative an interesting and a well managed book the book not only offers an in depth review of the current status of the knowledge of electrospinning and its biomedical applications but also discusses the emerging ideas and features both from the east and west with a focus on the needless electrospinning for the production of uniform fibers the book is equally helpful to the experts of this field who wish to enhance their understanding of the emerging technologies and to the new comers who can use this book as a reference

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